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OCTOBER 1981

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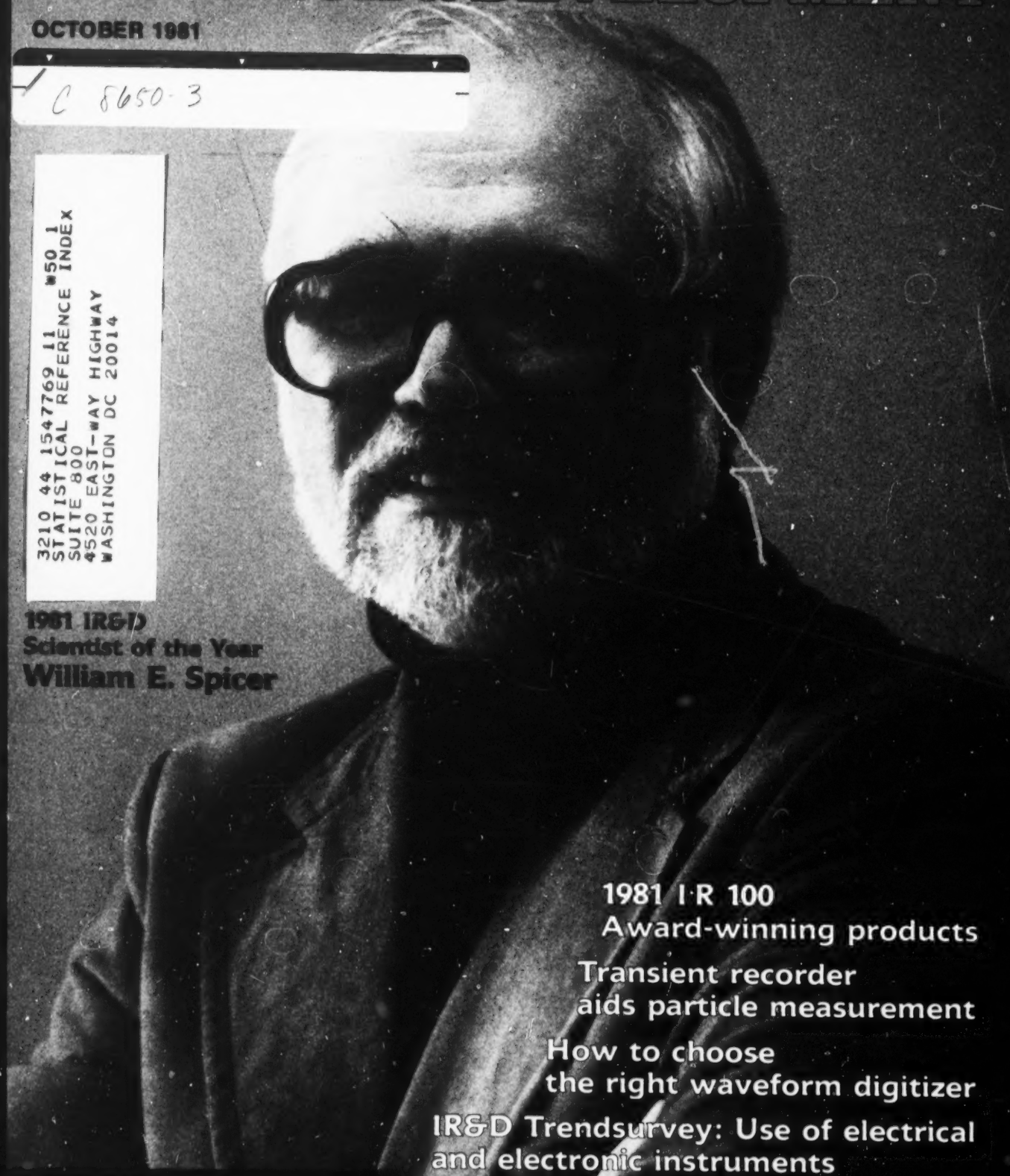

1981 IR&D Scientist of the Year
William E. Spicer

1981 I·R 100
Award-winning products

Transient recorder
aids particle measurement

How to choose
the right waveform digitizer

IR&D Trendsurvey: Use of electrical
and electronic instruments

News of importance to people in R&D

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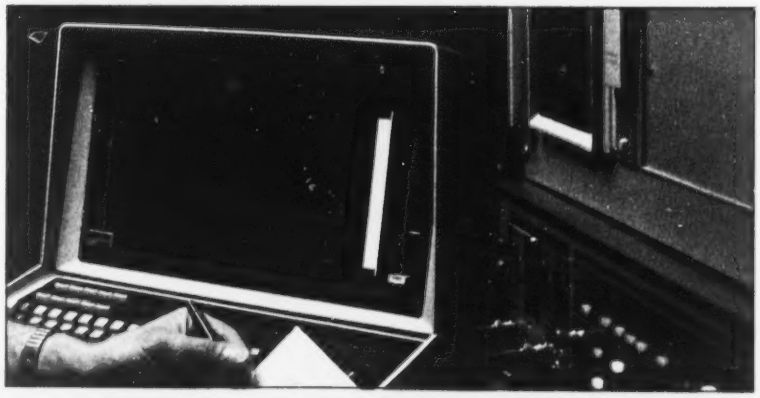
Waveform digitizer improves quality of measurements. See p. 174.



INDUSTRIAL RESEARCH & DEVELOPMENT

SERVING THE $142.5-BILLION WORLD-WIDE R&D INDUSTRY

EDITORIAL

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ABOUT THE COVER

"When I look back on my career, I realize that if I had been allowed to be only a pure scientist, which is what I intended to be when I left graduate school, I would have had a very limited career."

So says Dr. William E. Spicer, *IR&D*'s 1981 Scientist of the Year. In his early work, he discovered how to use photoemission as a tool in solid state physics.

At the present time, Spicer uses photoemission spectroscopy and synchrotron radiation to study the top layers of solids. He and his coworkers also are studying processes and reactions in the materials important in the working of a computer.

"One of the real problems we face today is the schism between pure science and applied science . . ." he says. ". . . young scientists should learn how to think . . . of concepts . . . [They] must get used to the idea that we are all on one team . . ."

An article about the 1981 Scientist of the Year begins on page 171. Cover photo for *IR&D* by Chuck Painter, Stanford News Service.

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NEWS OF SCIENCE AND TECHNOLOGY

59 **Science Policy:** Brookhaven's Isabelle accelerator faces budgetary cutbacks; NSF provides $11 million for experimental computer science research; R&D in fiber optic cabling gets $50 million boost from British Government.

61 **Environmnt:** An increase in atmospheric CO_2 in the last century has caused warming of the Earth; a 6,680 ft Greenland ice core will help geologists understand climatic changes in the last 100,000 years; study of gases discharged from Earth fault lines may help predict seismic events.

67 **Space:** The Voyager 2 Saturn fly-by has raised many more questions, especially about the planet's moons; NASA has launched two satellites to study Sun energy effects on Earth.

72 **Technology Export:** The Reagan administration appears to be altering its policy on technology exports by allowing pipelaying equipment sale.

78 **Lasers:** DBR lasers could provide higher power and focusing ability than present lasers; diffusive wiggler developed to tune free-electron lasers.

84 **Energy & Power:** Lithium-based batteries may replace zinc-carbon cells in the near future; electrodeposition processes produce 99.98% pure silicon for photovoltaics at $2/kg.

90 **Fusion:** European panel calls for U.S.-Common Market cooperation in fusion research and tokamak development.

Special Report — Exclusive Views of Presidential Science Advisor

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Special Report — Awards for New Products, Processes, and Materials

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ARTICLES

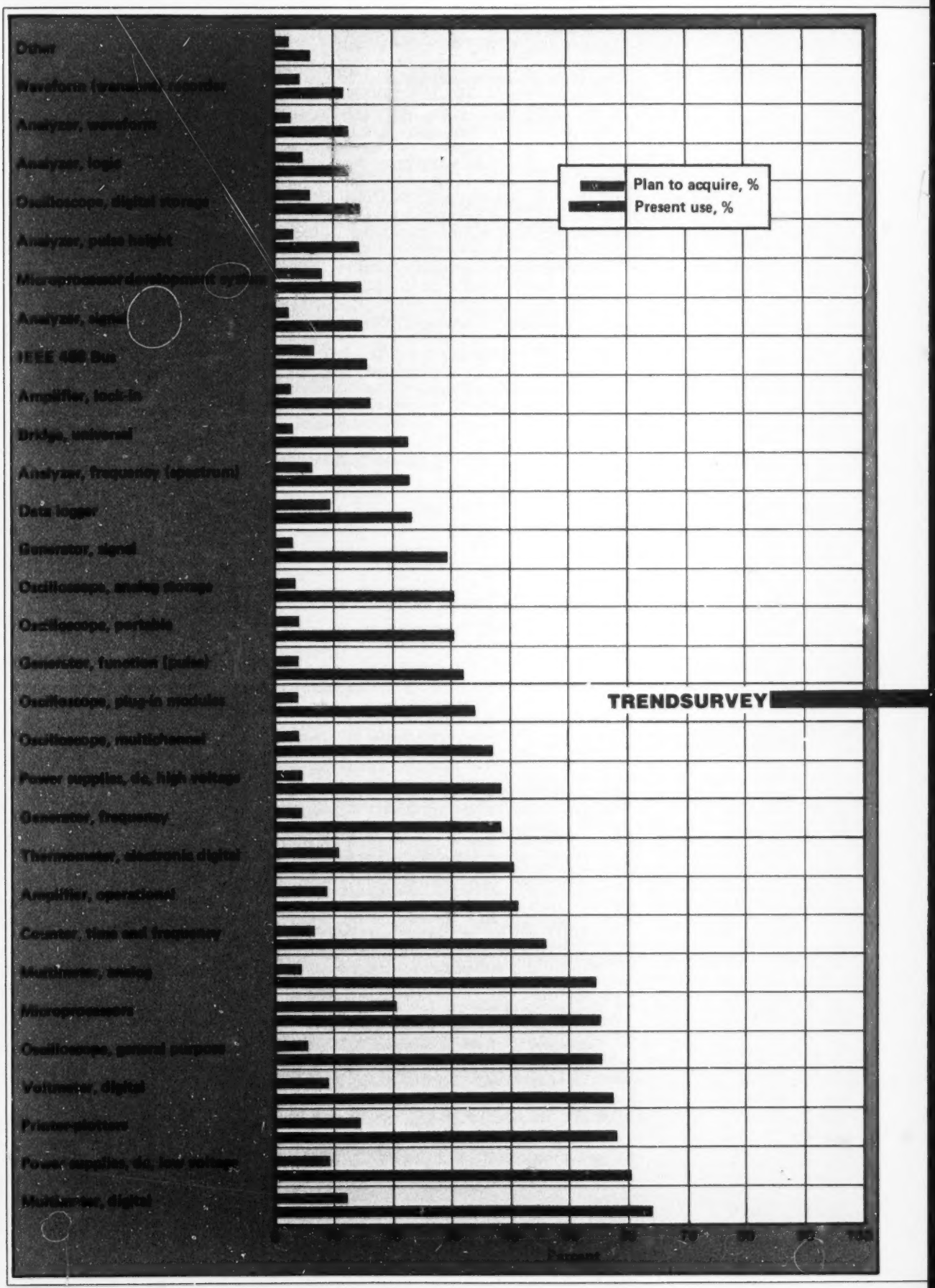
174 **Get the right waveform digitizer for your R&D needs:** R. Johnson and W. Baunach, Tektronix Inc.; these devices speed measurements and improve quality of data from repetitive and transient signals.

182 **Transient recorder aids laser Doppler study of particles:** C. J. Bates, University College, Cardiff (Wales); the capability for handling an unfiltered signal permits measurement of size and velocity.

188 **Advanced composites have advantages as industrial materials:** Irwin Stambler & N.B. Scheffel; strong plastics/fiber composites replace metals in structural applications and in filters.

196 ***IR&D* survey of electrical and electronic instrument usage:** C.J. Mosbacher, executive editor, *IR&D*; even when corrected for changing job emphasis, plans to purchase new equipment decline.

201 **"Charge-Rate" ion gaging system measures pressure:** J.J. Sullivan, MKS Instruments; simple circuit converts ion current to frequency to provide a digital display of pressure in scientific terms.


Other
Waveform (transient) recorder
Analyzer, waveform
Analyzer, logic
Oscilloscope, digital storage
Analyzer, pulse height
Microprocessor development system
Analyzer, signal
IEEE 488 Bus
Amplifier, lock-in
Bridge, universal
Analyzer, frequency (spectrum)
Data logger
Generator, signal
Oscilloscope, analog storage
Oscilloscope, portable
Generator, function (pulse)
Oscilloscope, plug-in modules
Oscilloscope, multichannel
Power supplies, dc, high voltage
Generator, frequency
Thermometer, electronic digital
Amplifier, operational
Counter, time and frequency
Multimeter, analog
Microprocessors
Oscilloscope, general purpose
Voltmeter, digital
Printer-plotters
Power supplies, dc, low voltage
Multimeter, digital
Plan to acquire, %
Present use, %
TRENDSURVEY
Percent

C.J. Mosbacher
Executive Editor

Use of electrical and electronic instruments

While demographic changes in readers responding to this year's survey mask the extent of the drop, it's evident that plans to acquire new instruments are lower than last year, with growth rates in many categories declining as a result.

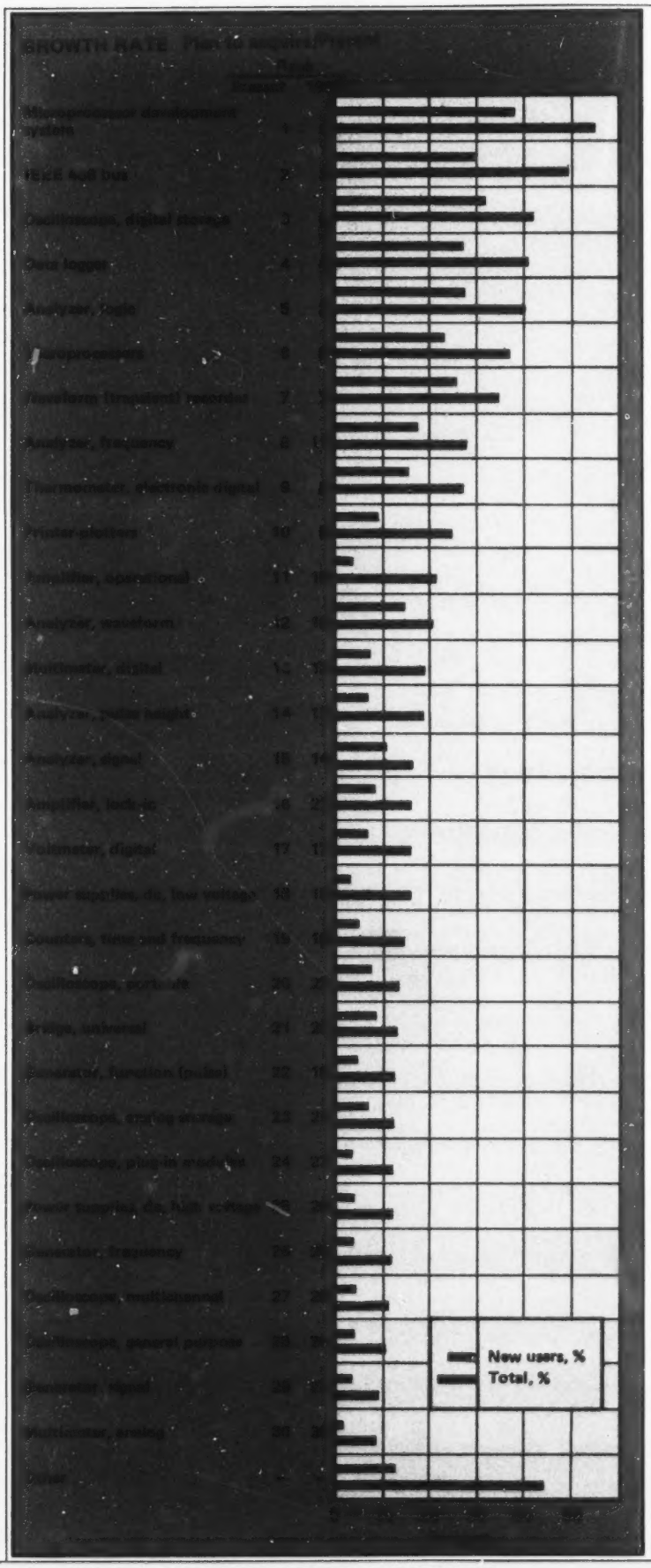
PLANS TO ACQUIRE electrical and electronic instruments within one year, averaged over the 30 categories listed in the IR&D Trendsurvey, dropped from 6.8% in 1980 to 6.2% in the 1981 results just tabulated. That's a decrease of almost 9%. But engineers, who normally have the highest present use and plans to acquire electronic instruments, are a smaller part of the total sample this year, down almost 7% from 1980. Conversely, life scientists and medical researchers represent almost 11% of the 1981 respondents, an increase of almost 3% over 1980.

Representation measured by other demographic categories such as job function and employer also changed slightly. Our interpretation of the results is that plans to acquire at best equal those of last year on average but most probably are about 2% less than in 1980 on the "unit" basis that is implied in the structure of the Trendsurvey. Measured on a cost basis, with increasing prices, plans to acquire electrical and electronic instruments probably are therefore higher in 1981 than they were in 1980. In other words, price increases have certainly been higher than 2%, and in many cases, than 9%.

The importance of digital instrumentation once again is confirmed, with the top six instruments in growth rate (plans to acquire based on present use of each type) all being digital. In fact, with minor shifts in order, these are the same six types that led in 1980. Notably, however, the top growth rate fell from 72.6% to 54.1%.

Results of the Trendsurvey are presented graphically on these pages. Present use and plans to acquire are graphed as a per cent of the total number of respondents on the facing page. Growth rates are summarized in the chart on the next page, which gives the total growth rate and the rate for new users—those who indicated they do not presently use an instrument but who plan to acquire it in the next year. Note that growth rates are calculated on the basis of present use, not on the total sample base used in the first illustration. Complete data giving numbers of respondents as well as percentages for the total sample and disciplines is given on the last page of this article.

As can be seen from the table, 45.3% of respondents gave engineering as their primary dis-



cipline, 42.0% physical science, and 10.8% life science or medicine. In 1980, the corresponding breakdown by discipline was 48.4%, 42.2%, and 7.9% respectively.

By employer, 60.0% of respondents work in industry, 17.3% in universities, 6.3% in nonprofit organizations, 2.0% in medical research centers, and 12.1% in other areas including government. In 1980, the corresponding numbers were 59.8%, 16.3%, 6.0%, 1.9%, and 13.5%.

By job function, 4.9% are corporate officers, 7.1% R&D executives, 16.5% project management, 66.2% professional staff, and 4.0% other. Last year, the 1980 numbers were 4.2%, 7.5%, 18.1%, 63.9%, and 5.0%. This demographic profile differs considerably from that in the IR&D circulation; this same discrepancy has been noted in all Trendsurveys to date. We believe that this is caused by those using instruments directly being more inclined to answer this survey.

In geographic terms, the distribution of respondents correlates well with the IR&D circulation, which in turn correlates with R&D funding and activity in the United States. New England accounts for 6.4% of the respondents to the 1981 Trendsurvey, the Middle Atlantic 17.3%, East North Central 16.1%, West North Central 5.1%, South Atlantic 13.4%, East South Central 3.5%, West South Central 6.6%, Mountain 6.3%, and Pacific 17.7%.

Average present use, without the "Other" category, declined from 33.7% in 1980 to 33.2% in the present Trendsurvey. Plans to acquire, calculated on the same basis, as noted earlier dropped from 6.8% to 6.2% for the total sample.

Variations in present use and plan to acquire averaged over the 30 categories (without other) was quite wide. Corporate officers gave present use of 29.9%, plans to acquire of 8.3%; on average; R&D executives 34.2% and 11.1%; project managers 36.0% and 7.8%; professional staff 32.8% and 5.6%; and other, 34.4% and 5.1%, respectively for present use and plan to acquire.

By discipline, the averages were 39.9% and 7.9% for engineering; 29.2% and 5.6% for physical science; and 22.2% and 4.1% for life science and medicine.

By employer, results were surprising. Industry present use and plans to acquire were 31.3% and 6.3%; universities 40.1% and 7.5%; nonprofit organizations 41.0% and 6.1%; medical research centers 30.5% and 6.9%; and other employer (including government) 32.9% and 5.9%. We suspect that the large plans of the university contingent were based on proposed Federal funding of instrument purchases that since have been eliminated from the budget.

As with earlier Trendsurveys, this study was conducted by including a prepaid reply postcard in a mailing to domestic IR&D subscribers in late May. By August 7, 1,449 cards had been returned. Ten cards could not be used because of multiple answers to demographic questions, leaving 1,439 respondents represented here. □

Growth rate (left) is calculated with present use as base for each instrument category. Total includes all those who plan to acquire; new users are those who do not presently use that particular instrument but who plan to acquire. Difference is present users planning to acquire additional or replacement instruments or equipment.

PRESENT AND PLANNED USE— data from 1,439 respondents

	Engineering, 652		Physical science, 605		Life science or medicine, 185			Engineering, 652		Physical science, 605		Life science or medicine, 185		Present users who plan to acquire		New users
No.	%	No.	%	No.	%	%	No.	%	No.	%	No.	%	%	No.	%	%
252	16.1	100	15.2	115	19.0	14	9.0	10	1.5	25	4.1	3	1.9	10.4	19	8.2	8.2
681	43.5	302	46.3	240	39.7	40	25.8	66	10.1	54	8.9	7	4.5	11.1	107	18.1	3.6
387	24.7	197	30.2	106	17.5	22	14.2	63	9.7	25	4.1	3	1.9	36.1	34	10.4	17.7
307	19.6	126	19.3	33	5.5	16	10.3	40	6.1	22	3.6	8	5.2	40.0	22	12.2	27.8
207	14.4	72	11.0	115	19.0	14	9.0	13	2.0	20	3.3	5	3.2	35.8	25	12.1	6.8
179	12.4	112	17.2	50	8.3	14	9.0	27	4.1	8	1.3	1	.6	28.6	12	6.7	14.0
314	21.8	126	19.3	62	10.2	24	15.5	18	2.8	14	2.3	4	2.6	19.0	14	6.5	10.3
334	23.2	204	31.3	90	14.9	23	14.8	28	4.3	13	2.1	1	.6	10.9	14	4.3	8.6
492	34.2	383	58.7	215	35.5	55	35.5	56	8.6	32	5.3	6	3.9	14.6	61	9.2	5.1
403	28.0	178	27.3	119	19.7	31	20.0	71	10.9	53	8.8	10	6.5	30.1	45	13.6	27.1
427	29.7	327	50.2	188	31.1	30	19.4	39	6.0	20	3.3	3	1.9	11.1	44	8.0	3.4
479	33.3	274	42.0	157	26.0	22	14.2	34	5.2	20	3.3	3	1.9	12.1	36	7.8	4.8
435	30.2	267	41.0	128	21.2	20	12.9	27	4.1	12	2.0	1	.6	5.7	25	5.9	3.5
199	13.8	132	20.2	79	13.1	11	7.1	57	8.7	43	7.1	8	5.2	36.2	43	19.3	29.6
797	55.4	378	57.9	327	54.0	83	53.5	149	22.9	116	19.2	26	16.8	27.1	191	24.0	13.2
328	22.8	148	22.4	49	8.1	9	5.8	74	11.3	30	5.0	9	5.8	34.1	33	15.8	38.3
785	54.5	406	62.3	312	51.6	52	33.5	38	5.8	25	4.1	1	.6	6.4	53	6.8	1.5
931	64.7	470	72.1	379	62.6	57	36.8	94	14.4	70	11.6	7	4.5	19.1	110	11.9	7.2
445	30.9	260	39.9	142	23.5	33	21.3	31	4.8	18	3.0	6	3.9	12.1	24	5.5	7.1
256	17.8	148	21.3	55	9.1	6	3.9	53	8.1	26	4.3	6	3.9	32.1	21	10.2	32.0
788	54.7	428	65.9	304	50.2	56	36.1	49	7.5	23	3.8	6	3.9	10.2	49	6.1	4.0
531	36.9	321	49.7	169	27.9	36	23.2	40	6.1	15	2.5	3	1.9	11.1	35	6.6	4.5
494	34.3	283	43.4	166	27.4	29	18.7	37	5.7	16	2.6	3	1.9	12.8	40	8.3	3.7
441	30.6	261	40.0	150	24.8	23	14.8	39	6.0	18	3.0	2	1.3	10.3	26	5.9	7.5
693	48.1	246	37.7	243	40.2	53	34.2	27	4.1	32	5.3	6	3.9	11.3	44	8.0	3.8
969	67.3	458	69.9	334	55.2	63	40.6	78	12.0	47	7.8	8	5.2	8.5	110	12.7	3.0
834	57.9	368	56.1	382	63.1	73	47.1	103	15.8	84	13.9	19	12.3	24.7	127	15.2	9.7
683	47.4	306	46.9	223	36.9	48	31.0	86	13.0	56	9.3	14	9.0	17.7	69	11.8	15.4
635	44.1	435	66.7	317	52.4	63	40.6	64	9.8	55	9.1	10	6.5	9.1	18	9.2	6.6
190	13.2	103	15.8	52	8.6	13	8.4	34	5.2	23	3.8	1	.6	14.1	14	8.3	26.0
90	6.2	46	6.4	32	5.3	9	5.8	13	2.0	13	2.1	4	2.6	54.7	19	21.8	12.6

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